(No Model.) 2 Sheets—Sheet 1.

H. K. DE PAWLOWSKI.

APPARATUS FOR BLEACHING VEGETABLE AND ANIMAL MATTER.

No. 453,975. Patented June 9, 1891.

Fig. 1.

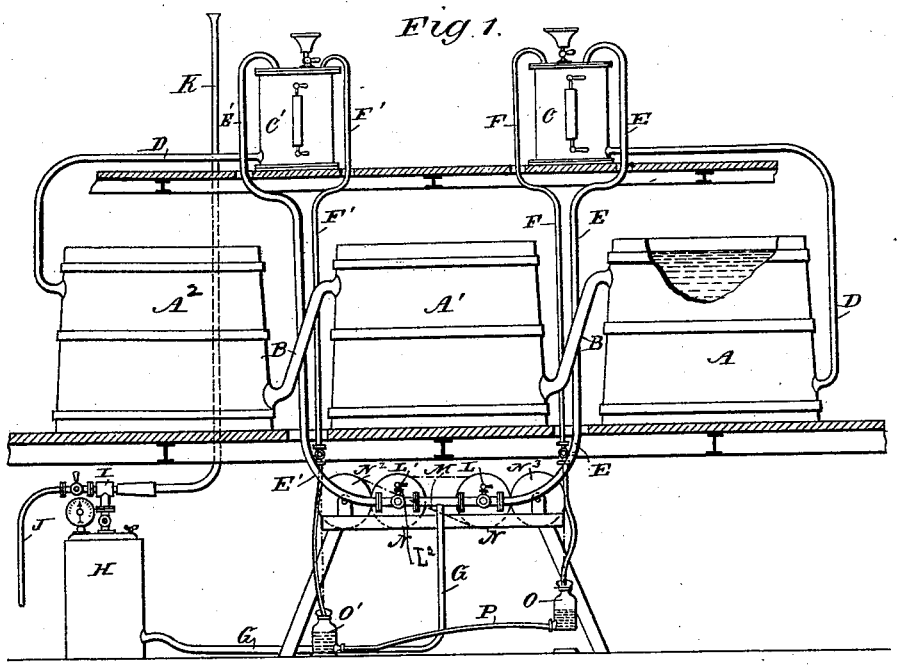

Fig. 2.

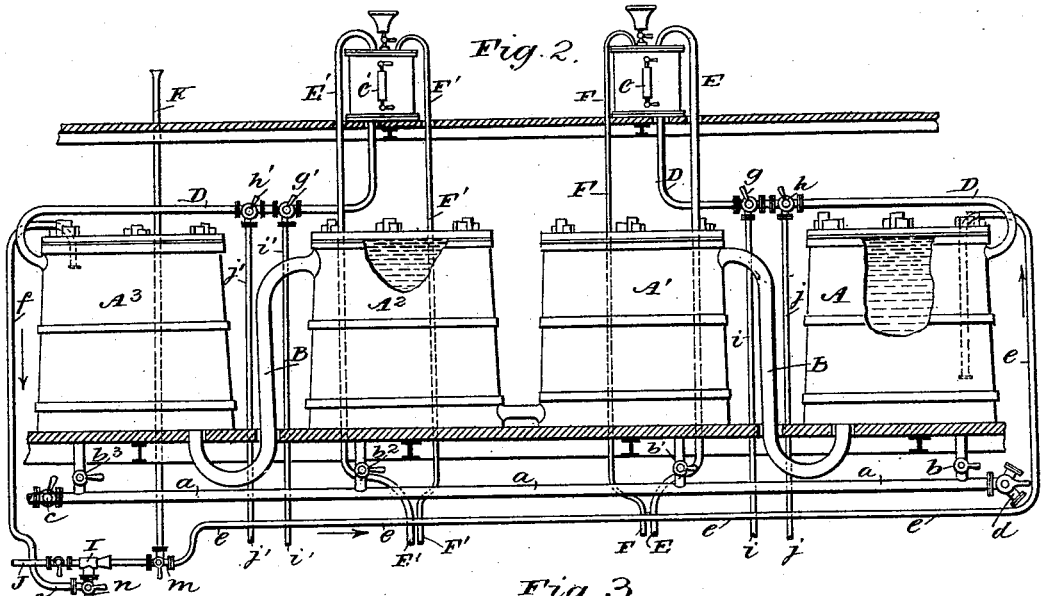

Fig. 3.

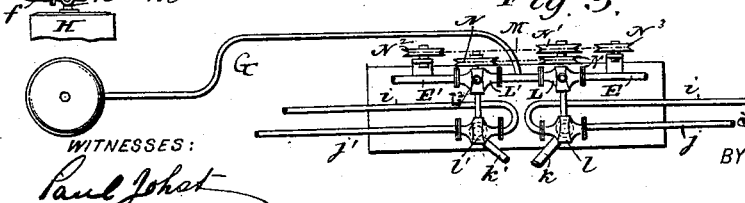

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Fig 4.

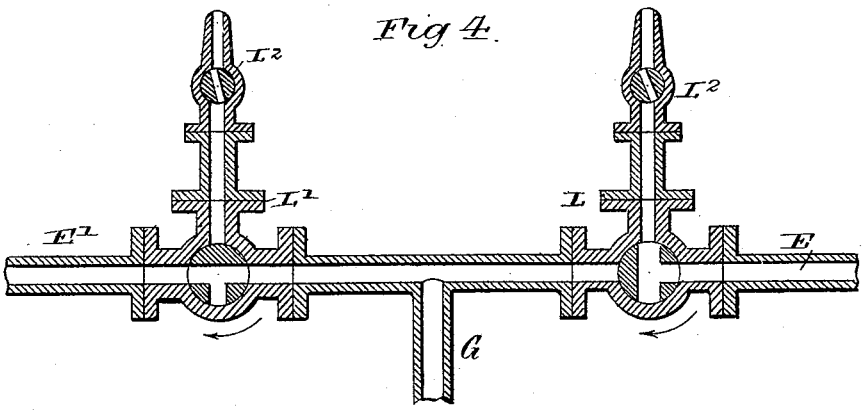
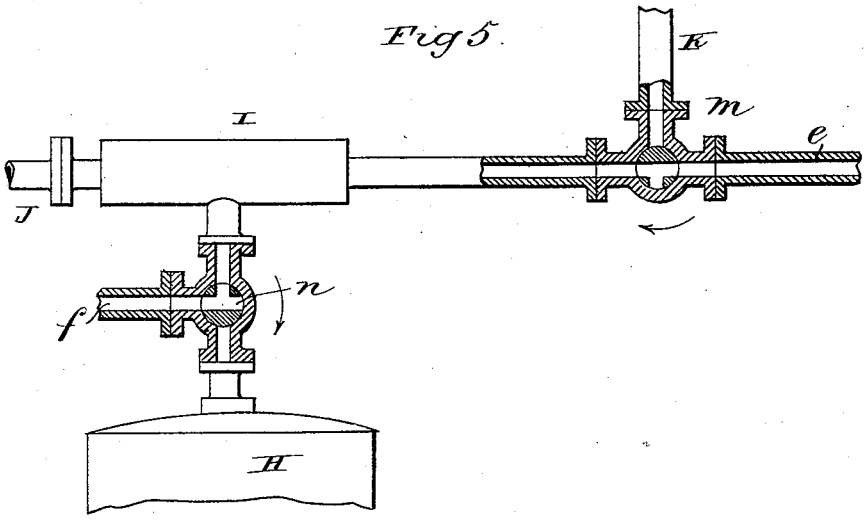


Fig 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR BLEACHING VEGETABLE AND ANIMAL MATTER.

SPECIFICATION forming part of Letters Patent No. 453,975, dated June 9, 1891.

Original application filed October 11, 1889, Serial No. 326,700. Divided and this application filed May 27, 1890. Serial No. 353,327. (No model.) Patented in France October 28, 1885, No. 171,927, and in England February 15, 1887, No. 2,354.

To all whom it may concern:

Be it known that I, HONORÉ KORWIN DE PAWLOWSKI, a subject of the Czar of Russia, at present residing in Paris, France, have invented a new and Improved Apparatus for the Bleaching of Vegetable and Animal Matter and the Cleansing of Wool and other Substances, (for which I have obtained Letters Patent in Great Britain, dated February 15, 1887, No. 2,354, and in France, dated October 28, 1885, No. 171,927, this application being a division of the United States application, Serial No. 326,700, filed by me October 11, 1889,) of which the following is a full, clear, and exact description.

The object of this invention is to provide a new and improved apparatus for the bleaching of vegetable and animal matter, &c., and the washing and scouring of wool and other substances, either woven or yarn or fiber, and serving to avoid manipulation—such as stirring, agitating, or repeated plunging of the material to be treated—hitherto indispensable to the effective decoloration or bleaching of vegetable or animal matter, such as silk, wool, flax, hemp, jute, esparto-grass, and the like, either raw or as yarn or as tissue, and also straw, hair, feathers, and the like.

The apparatus consists of a series of vats connected with each other and with vacuum-receptacles placed on a higher level.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is an elevation of the apparatus, parts being in section and parts being broken out, in connection with open vats. Fig. 2 is a like view of the same in connection with hermetically-closed vats, and Fig. 3 is a plan view of the hydraulic balance. Fig. 4 is an enlarged sectional view of the balance-cocks, and Fig. 5 is a like view of the injector-cocks.

The apparatus may be used in connection with any desired number of vats A A′ A^2, &c., placed on the same level, and into which the material to be treated is placed, either on false perforated bottoms or on hooks or bars fixed in the interior of the vats. When the vats are open, as shown in Fig. 1, they are connected with each other by pipes B, and on a higher level are placed two hermetically-closed receptacles C and C′, provided with charging-funnels and gage-glasses. The receptacles C and C′ are connected with the two end vats of the series by means of pipes D, and are provided on the top with pipes E F and E′ F′, respectively, which connect said receptacles to the hydraulic balance, which produces a vacuum alternately in the two receptacles.

The level of the liquid in the several vats A, A′, and A^2 stands at all times above the upper ends of the pipes B and the lower end of the pipes D, so that the openings of the said pipes into the vats remain sealed. The amount of liquid above the said openings of the pipes in the vats is sufficient to fill the receptacles C and C′ from the vats, in the manner hereinafter more fully described, without unsealing the openings of the said pipes near the upper ends of the vats.

The hydraulic balance represented in Fig. 1 and in plan view in Fig. 3 consists of any convenient support carrying the pipes E E′, coming from the tops of the two receptacles C and C′, which pipes are here connected and joined to another pipe G, leading to an air-tight chamber H, in which the vacuum is produced by means of an injector I J K, connected therewith and of any approved construction. Each of the two pipes E and E′, coming from the top of the receptacle C or C′, is provided near the junction with the pipe G, leading to the vacuum-chamber H, with a three-way cock L or L′, respectively, the top opening of which opens or closes a small pipe L^2, provided with a valve which regulates the re-entrance of the air into the receptacles C and C′. The three-way cocks L and L′ are so arranged that when one is open the other is closed. In order to alternately open and close the said cocks L and L′, they are provided on their valve-stems or axes with pulleys N, over which passes an endless belt or band. On the valve-stem of the cock L is secured a second pulley N′, and similar pulleys N^2 and N^3 are arranged in line with the pulley N′ and are mounted to turn on the support of the balance, as plainly shown in Figs. 1 and 3. A band M

passes over the pulleys N^2 and N^3 and under the pulley N′, the ends of the band hanging downward from the pulleys N^2 and N^3. When the band M is moved, the pulley N′ is rotated, thus rotating simultaneously the connected valve-stems of the three-way cocks L and L′, thereby shifting the latter simultaneously. To the ends of this band are fastened small receptacles or bottles O O′, containing a certain quantity of liquid. The bottles are connected by a pipe P with each other, and each of them by a pipe F or F′ with the top of its corresponding large receptacle C or C′ placed above the vats, as before described. The two small receptacles or bottles fastened to the ends of the band are so arranged that when one stands on the ground the other is suspended in the air, as is plainly shown in Fig. 1.

Suppose that a three-way cock is open, which leads to the receptacle, the bottle of which is suspended. The vacuum will form there, as also in the bottle connected with it, and the bottle will naturally fill with the liquid drawn from the other bottle as this latter empties itself and the former fills, so that the formerly-suspended bottle will sink by its own weight and pull on the end of band M, connected with it, so that the band is moved downward at this end, while the other end of the band, with its empty bottle, rises. The movement of the band acts on the pulley N′, as above described, so that the position of the cocks L and L′ is changed. The three-way cock connected with it will close and the other open, and the same process will repeat itself on the other side. By the small air-cocks above the three-way cocks the time of the filling of the receptacles, as well as the time of the hydraulic-balance movement, is regulated. It will thus be seen that when a vacuum is produced in one of the receptacles it will fill itself with the liquid from the vat connected therewith, and the liquid in this vat will be replaced by that of the next, and so on to the end of the series. If, therefore, the vacuum is produced alternately in the two receptacles connected to the two end vats, a continuous flow of a part of the liquid through the entire series of vats will take place, the quantity displaced being dependent upon the size of the receptacles.

It is understood that the amount of liquid passing back and forth by the alternating action of the vacuum in the receptacles C and C′ is limited to the size, capacity, or cubic contents of the said receptacles.

Hermetically-closed vats—such as represented in Fig. 2—are preferably used when a liquid is employed which contains gaseous decoloring or bleaching agents, such as oxygenized water or water charged with sulphurous acid or the like. In this case the apparatus is preferably arranged as follows: Supposing a series of four vats are to be used, only one of the middle ones will be filled with the liquid, which will be drawn from one of the middle vats to the other and back without entering the outer vats by the alternate action of the vacuum in the receptacles C or C′, respectively, connected with the outer vats A or A^3, respectively, which contain no liquid, and in which the vacuum is produced by being connected with the said receptacles. The alternate vacuum in the outer vats draws the liquid alternately from one of the middle vats A′ or A^2 to the other and back without entering the outer vats A or A^3, in which the material to be treated is placed in a suitably-dampened condition. Thus the gaseous agents disengaged from the liquid will alternately be drawn into and fill the outside vats and here encounter the material to be treated. The liquid may also be heated by an arrangement of pipes, and the apparatus will then be applicable to the washing and scouring of wool. In most cases, in fact, the materials to be bleached contain impurities from which they should be freed, and the disposition of pipes hereinafter described permits the easy attainment of that result.

As is clearly shown in Fig. 2, I have arranged under the vats a pipe *a a*, communicating with the bottom of each by means of branches furnished with cocks *b b′* b^2 b^3 and bearing at its extremities the cocks *c* and *d*, of which the use will be explained farther on. Elsewhere on the discharge-pipe of the injector I is fitted a pipe *e*, emptying into the bottom of the vat A, and on the suction-pipe of this injector is branched a pipe *f*, leading into the top of the vat A^3. Finally the three-way cocks *m* and *n* are placed at the points of junction of these pipes with the injector I. Under these conditions, the materials to be washed or bleached being placed in the vats, it is sufficient to open one branch of the cock *d* and the cocks *b b′* b^2 b^3 of the pipe *a a* to fill these vats with water (charged with carbonate of soda, for example) which is contained in a reservoir above. (Not shown.) Afterward these various cocks are closed and the steam turned on in the injector I, thus setting the keys of the three-way cocks *m* and *n* so as to cause a rapid circulation of the liquid in the vats which communicate with each other by the pipes B, indicated above. The circulation operates in the direction indicated by the arrows placed near the pipes *e* and *f*. By the condensation of the steam in the injector I the liquid in the vats becomes heated and facilitates the washing and scouring of the materials. When it is judged that the operation is finished, the pressure of steam is interrupted by the pipe J, and I proceed to empty the impure water contained in the vats by opening the cocks *b b′* b^2 b^3 and the cock *c*, which empties the liquid into the sewer. This operation can be repeated several times, if necessary, and it is understood that during the washing the vats should be uncovered. Let me indicate, also, that if desirable to produce a violent agitation in the vats to facilitate the operation of washing above described one can proceed as follows: The vats in this

case being closed hermetically a sufficient or comparative vacuum is caused by means of the injector I and the medium of the upper receptacles *c c'*. Then at this moment open the cocks *b b* of the pipe *a a*, as well as the branch of the cock *d*, which communicates with the open air. It is easy to understand that the rapid return of the air which takes place at this moment in the lower part of the vats, causes a violent agitation of the liquid which they contain, and which has for effect the putting in suspension of the impurities which otherwise might remain entangled in the mass of material under treatment. Finally, when one would have the operations of washing and scouring of materials to be bleached accomplished in a progressive and methodical manner the use of the hydraulic balance above described is employed, and which is furnished for this purpose with the two auxiliary three-way cocks *l* and *l'*, above described.

Elsewhere, the pipes D D are, as seen in Fig. 2, furnished with three-way cocks *g h* and *g' h'*, which communicate by means of the pipes *i j* and *i' j'* with the two extremities of the cocks *l* and *l'*, of which the third tubing placed below carries the pipes *k k'*, ending at the sewer. It is easy to see that by arranging then the keys of the cocks *g h* and *g' h'* in such manner the circulation of the liquid between the exterior vats A and A^3 and the receptacles *c* and *c'*, which correspond therewith, respectively, can only be accomplished by the intermediary of the cocks *l* and *l'*, resulting in the automatic play of the hydraulic balance. At each displacement of this latter the liquid, which will have been exhausted by one or the other of these upper receptacles *c* and *c'*, will be found automatically ejected alternately by the two sets of pipes *i j* and *i' j'* and their connections into the sewer, as well as the impurities which it contains, and it will suffice to regulate the opening of the cocks *b b' b^2 b^3* to permit the entry of an equivalent quantity of the pure liquid to insure the progressive purification of the material contained in the vats. In this case I prefer to place the cock *d*, supplying the pure liquid, in the middle of the series of vats, so as to regulate methodically the introduction of this liquid into the apparatus. This arrangement is especially convenient when the pipe *a a* should serve to induce a rapid entrance of air in the vats to provoke a lively agitation of the materials they contain.

In order to more clearly show the working of the cocks *l l'*, suppose the cocks *g* and *h* are set so as to connect the receptacle C with the pipe *i* and the vat A with the pipe *j*, and the cock *l* connects the pipes *i j* with each other, and when now a vacuum is produced in the receptacle C the liquid flows from the vat A, through the pipe D, past cock *h* into pipe *j*, through cock *l* into pipe *i*, through cock *g* into upper part of pipe D, and finally into the receptacle C. Now, when a vacuum is produced in the other receptacle C' and the hydraulic balance is actuated, as previously described, the position of cock *l* is changed, so as to connect the pipe *i* with the sewer-pipe *k*, the pipe *j* being shut off. The impure liquid in the receptacle C now flows through pipe D, (connected at bottom of receptacle C,) past cock *g*, into pipe *i*, and through cock *g* into sewer-pipe *k* to be discharged. When the hydraulic balance again reverses by vacuum in the receptacle C, the cock *l* is again changed, so as to disconnect the sewer-pipe *k* and connect the pipes *i* and *j* with each other. A similar operation takes place at the other set of cocks *g'*, *h'*, and *l'*.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a series of vats containing liquid and connected with each other below the level of the liquid, of two vacuum-receptacles placed on a higher level than the said vats and connected with the latter below the level of the liquid to effect alternately an automatic displacement of the liquid in the said vats, substantially as shown and described.

2. The combination, with a series of vats containing liquid and connected with each other below the level of the liquid, of two vacuum-receptacles placed on a higher level than the said vats and connected with the latter below the level of the liquid to effect alternately an automatic displacement of the liquid in the said vats, and means, substantially as described, for alternately forming a vacuum in the said receptacles, as set forth.

3. The combination, with connected vats and vacuum-receptacles connected therewith, of a hydraulic balance connected with the said receptacles and operating under the action of the vacuum and the adjustable oscillations to assure the automatic and alternate displacement of the liquid in the said vats, substantially as shown and described.

4. The combination, with a series of vats containing liquid and connected with each other alternately on top and bottom below the level of the liquid, of two vacuum-receptacles placed on a higher level than the said vats and connected with the two end vats below the level of the liquid, substantially as shown and described.

5. The combination, with a series of hermetically-closed vats containing liquid and connected with each other and two hermetically-closed end vats connected with the adjacent liquid-vats, of vacuum-receptacles placed on a higher level than the said vats and connected with the two end vats to produce a vacuum therein to cause an automatic displacement of the liquid in the said filled vats, substantially as shown and described.

6. The combination, with a series of hermetically-closed vats containing liquid and connected with each other and two hermetically-closed end vats connected with the ad-

jacent liquid-vats, of vacuum-receptacles placed on a higher level than the said vats and connected with the two end vats to produce a vacuum therein to cause an automatic displacement of the liquid in the said filled vats, and means, substantially as described, for alternately forming a vacuum in the said vacuum-receptacles, as set forth.

7. The combination, with a series of connected vats, of two vacuum-receptacles connected with the two end vats of the said series of vats, a main pipe connected with a vacuum-producer and provided with branch pipes connected with the said vacuum-receptacles, three-way cocks or valves held in the said branch pipes to alternately connect the latter with the said main pipe and the outer air, and a hydraulic balance operating under the action of the vacuum and controlling the said three-way cocks, substantially as shown and described.

8. The combination, with a series of connected vats, of two vacuum-receptacles connected with the two end vats of the said series of vats, a main pipe connected with a vacuum-producer and provided with branch pipes connected with the said vacuum-receptacles, three-way cocks or valves held in the said branch pipes to alternately connect the latter with the said main pipe and the outer air, and a hydraulic balance operating under the action of the vacuum and controlling the said three-way cocks, and a second set of three-way cocks controlled from the said balance simultaneously with the said first-named three-way cocks, and pipes containing the said second set of three-way cocks and arranged to establish an alternate connection of the end vats with the vacuum-receptacles and of the latter with a sewer discharge-pipe, substantially as shown and described.

9. The combination of a series of connected vats containing a liquid, an injector connected by its discharge-pipe with one of the end vats and by its suction-pipe with the other end vat, and three-way cocks placed in the said discharge and suction pipes, substantially as shown and described.

10. The combination of a series of connected vats containing a liquid, an injector connected by its discharge-pipe with one of the end vats and by its suction-pipe with the other end vat, three-way cocks placed in the said discharge and suction pipes, and a general outlet-pipe connected by valved branch pipes with the bottoms of the said vats, substantially as shown and described.

Paris, the 19th April, 1890.

HONORÉ KORWIN DE PAWLOWSKI.

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